CHAPTER 107

Geotechnical Process

Design Memorandum	Revision Date	Sections Affected
13-08	Mar. 2013	Ch. 18 superseded by Ch. 107

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CHAPTER 107

GEOTECHNICAL PROCESS

This Chapter discusses the elements of geotechnical engineering which the designer is required to address during the design of a project. This chapter does not address the analyses and procedures conducted by a geotechnical consultant or the Office of Geotechnical Services during its investigation. The designer should review the Geotechnical Report and contact the geotechnical engineer for additional information if required.

107-1.0 GENERAL INFORMATION

For all subsurface information required for the geotechnical engineering design of an INDOT project, the Office of Geotechnical Services shall be contacted. The designer is responsible for submitting to the Office of Geotechnical Services a request for a geotechnical waiver or the Geotechnical Report for an LPA project.

For additional information refer to the INDOT *Geotechnical Manual* located at: http://www.in.gov/indot/2804.htm.

107-2.0 GEOTECHNICAL WAIVER OR INVESTIGATION

The following project types will not require a geotechnical waiver or investigation:

1. bridge painting;
2. pavement marking;
3. landscaping;
4. guardrail;
5. traffic signals;
6. wedge and level;
7. sheet sign;
8. herbicide;
9. sweeping;
10. tree removal or trimming;
11. mowing;
12. pipe lining;
13. lighting maintenance; or

14. project without earthwork, foundations or retaining walls.

A project belonging to one of the following categories may qualify for a waiver if a subgrade recommendation is not required.

1. Preventative Maintenance Project.
   a. Chip Seal, Crack Sealing, Microsurfacing, Single Lay HMA Mill, or Functional HMA Overlay.
   b. PCCP Joint Sealing, Retrofit Joint Transfer.

2. Rehabilitation Project: Shoulder widening of 2 ft with less than 2 ft of cut or fill.

3. Bridge Maintenance or Repair Project that does not require foundation work.

4. Small Structure Project: Pipe structure smaller than 36 in. in diameter, or equivalent, or a structure extension of less than 5 ft.

All other projects will require a geotechnical investigation.

Upon approval of the Stage 1 Review Submission or Preliminary Plan Review Submission the geotechnical waiver or investigation should be requested for an INDOT project. The request for a geotechnical waiver should be submitted prior to the Preliminary Field Check for an LPA project. These requests will be uploaded to ERMS. The Office of Geotechnical Services must be notified, via email, of these submissions.

If the project is eligible for a geotechnical waiver the designer should submit the following:

1. Geotechnical Waiver or Investigation Request Transmittal form, Figure 107-1A. An editable version of the form is available for download at: http://www.in.gov/dot/div/contracts/design/dmforms/index.html;
2. scoping document, e.g. Engineer's Report, Abbreviated Engineer's Assessment;
3. plans;
4. cross sections; and
5. a minimum of six (6) existing-pavement photographs.

If the project requires a geotechnical investigaton the designer should submit the following items. See Sections 14-2.01(04) for additional information:

1. Geotechnical Waiver or Investigation Request Transmittal form, Figure 107-1A. An editable version of the form is available for download at: http://www.in.gov/dot/div/contracts/design/dmforms/index.html;
2. scoping document, e.g. Engineer's Report, Abbreviated Engineer's Assessment;
3. plans;
4. cross sections, including a list of all areas where side slopes are 2:1 or steeper;
5. a minimum of six (6) existing-pavement photographs;
6. magnitude of both total and differential allowable settlement for bridges;
7. approximate maximum elevation feasible for top of foundation at an abutment;
8. number of columns anticipated at interior substructure units if there will be a single foundation element for each column;
9. depth of scour;
10. vertical foundation loads;
11. lateral foundation loads where anticipated foundation supports are drilled shafts;
12. all known constraints that would affect the foundations in terms of type, location, or size; and
13. all known constraints which can affect the nominal resistance of the foundation, e.g. utility conflicts, construction staging, shoring or falsework, and constructability issues.

The designer should ensure the following information is included for either submittal:

1. project description;
2. project location with starting and ending stations;
3. anticipated pavement treatment, e.g. resurface or rubilize;
4. details and limiting stations for new pavement, pavement widening, resurfacing and reconstruction;
5. wetland boundaries and limits;
6. right of way;
7. roadway alignments;
8. roadway typical sections;
9. retaining wall locations, profiles, cross sections, and aesthetic requirements;
10. drainage structures; and
11. bridge layout and general plan with anticipated structure type shown.

Information regarding scope changes or design changes should be immediately relayed to the Office of Geotechnical Services.

107-3.0 GEOTECHNICAL REPORT

There should be communication between the geotechnical engineer and the designer during the following phases of design to ensure the Geotechnical Report recommendations address all aspects and conditions of the project:

1. preliminary foundation design;
2. structural analyses and modeling;
3. final foundation design;
4. final roadway embankment and retaining wall design;
5. final pavement design; and
6. constructability and construction staging.

If the project includes a structure as defined in Section 408-1.06(01), the Geotechnical Report will include a preliminary foundation recommendation. The designer should review the preliminary foundation recommendation in the Geotechnical Report to determine if it provides adequate information. If additional foundation recommendation information is required the designer should provide the geotechnical engineer with the following information:

1. anticipated foundation loads, including load factors and load groups used;
2. foundation size or diameter and depth required to meet structural needs;
3. foundation details that could affect the geotechnical design of the foundations; and
4. size and configuration of deep foundation groups.

The geotechnical engineer will then provide a final foundation recommendation.
The designer of an LPA project will submit the draft Geotechnical Report to the Office of Geotechnical Services via ERMS for approval. Notify the Office of Geotechnical Services, via email, that the submission has been made.

107-4.0 FOUNDATION REVIEW

Structures requiring foundation reviews are delineated in Section 408-1.06(01). The procedure for submitting the Foundation Review form is delineated in Section 408-1.06(02).

107-5.0 GEOTECHNICAL REVIEW OF FINAL CHECK PRINTS

If a Geotechnical Report is prepared for an INDOT project, the designer will upload the Geotechnical Review of Final Check Prints form, see Figure 107-5A, along with the

Geotechnical Report to ERMS at the Stage 3 Review Submission, Final Plans Submission, or Final Check Prints Submission. The designer shall notify the Office of Geotechnical Services, via email, of the submission. If a Geotechnical Report is prepared for an LPA project the designer will transmit the Geotechnical Review of Final Check Prints form to the geotechnical engineer. The form is available for download from the Design Manual Editable Documents webpage, http://www.in.gov/dot/div/contracts/design/dmforms/index.html. The geotechnical engineer will review the plans, resolve all discrepancies between the plans and geotechnical requirements with the designer, and return a signed copy of the Geotechnical Review of Final Check Prints form to the designer.

The designer will upload the signed Geotechnical Review of Final Check Prints form along with the Geotechnical Report to ERMS at the Final Tracings Submission.

If a Geotechnical Waiver was obtained, it shall be uploaded to ERMS at the Final Tracings Submission.

107-6.0 GEOTECHNICAL ISSUES AND TREATMENTS

107-6.01 Common Geotechnical Issues

There are numerous areas throughout the state where geotechnical anomalies occur and special subsurface treatments should be considered. Figure 107-6A, Indiana Counties with Geotechnical Concerns, illustrates the counties where the designer can encounter coal mine subsidence, peat, sink holes or karst areas, and landslide conditions. The Geotechnical Report will recommend solutions for these geotechnical issues. Common geotechnical issues the designer may encounter are as follows:

1. coal-mine subsidence;
2. landfills;
3. landslides;
4. peat;
5. sink holes;
6. steep slopes;
7. fill on unsuitable foundation; and
8. seismic zones.

107-6.02 Benching

Benching is used on an embankment to stabilize proposed fill on existing slopes by excavating the existing material on the side slopes to eliminate a plane of weakness or to provide a greater mass of stable material at the toe of slope. Benching should be considered if the existing slope is steeper than 4:1. The INDOT *Standard Specifications* provide the criteria for where benching should be provided on an embankment. See Figure 107-6B, Typical Benching Methods, for embankment benching.

Benching in a cut section is provided only in a rock cut to provide a debris collection area for a rock slide. Figure 107-6C, Typical Rock Cut Benching, Rock Depth ≤ 10 ft, Figure 107-6D, Typical Rock Cut Benching, Rock Depth > 10 ft, and Figure 107-6E, Typical Soft/Weathered Rock Cut Benching, illustrate the benching procedures for a rock cut.

GEOTECHNICAL WAIVER OR INVESTIGATION REQUEST TRANSMITTAL

_____, 20___

MEMORANDUM

To: _____
Manager, Office of Geotechnical Services

Thru: _____
Project Manager

From: _____
Designer

_____
INDOT location or consulting-firm name

Re: Geotechnical Waiver ☐ Investigation ☐

Route: _____
Des. No.: _____
Project Location: _____
Project Description: _____

A geotechnical waiver ☐ investigation ☐ is requested for the above referenced project. The following documents are included:

- ☐ Plans (Indiana Design Manual Section 107-2.01)
- ☐ Cross Sections (including a list of areas where side slopes are 2:1 or steeper)
- ☐ Scoping Document (e.g. Engineer's Report, Abbr. Engineer's Assessment)
- ☐ Bridge Information (Indiana Design Manual Section 107-2.01 and 107-3.0)
- ☐ A minimum of six existing pavement photographs

The geotechnical investigation results are requested by , 20 . If additional items which would require a geotechnical investigation are anticipated to be added to the plans after this submission, list those items and the estimated number of locations below.

Item: _____ No. of Locations: ___
Item: _____ No. of Locations: ___
Item: _____ No. of Locations: ___

Figure 107-1A

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GEOTECHNICAL REVIEW OF FINAL CHECK PRINTS

Route: _____
Des: _____
Bridge File: _____
Over: _____
Project No.: _____
Date of Geotechnical Report: _____
Date of Addenda to Geotechnical Report: _____

I have reviewed the Final Check Prints and the geotechnical summary for the project described above.

☐ The Final Check Prints and the special provisions are consistent with the Geotechnical Report and its addenda. No changes are required.

☐ The Final Check Prints and the special provisions are not consistent with the Geotechnical Report and its addenda. The following must be addressed.

_____

☐ The geotechnical summary as submitted by the designer is satisfactory to include in the Contract Information book.

☐ The geotechnical summary as submitted by the designer is not satisfactory. The following must be addressed.

_____

_____
Signature of Geotechnical Engineer

_____
INDOT entity or consultant

_____
date

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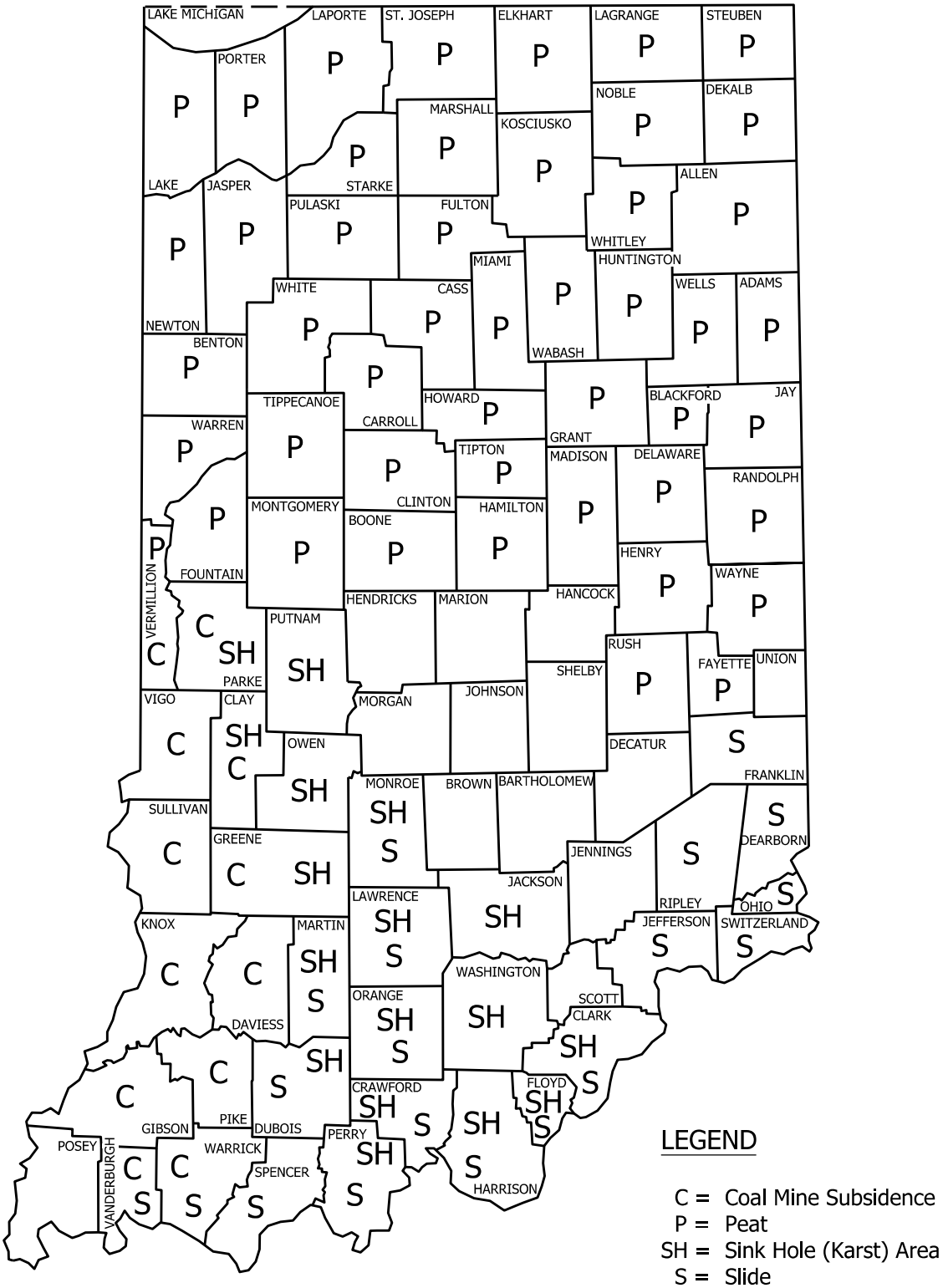

INDIANA COUNTIES WITH GEOTECHNICAL CONCERNS

Figure 107-6A

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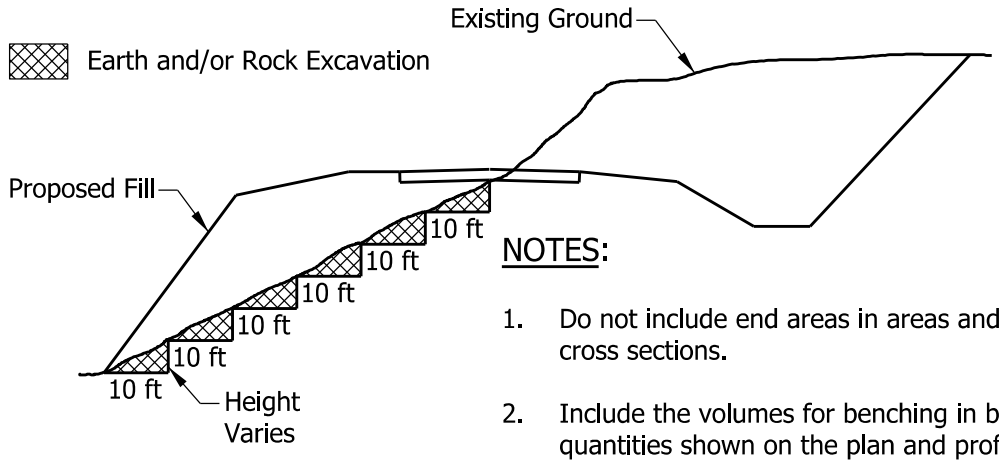
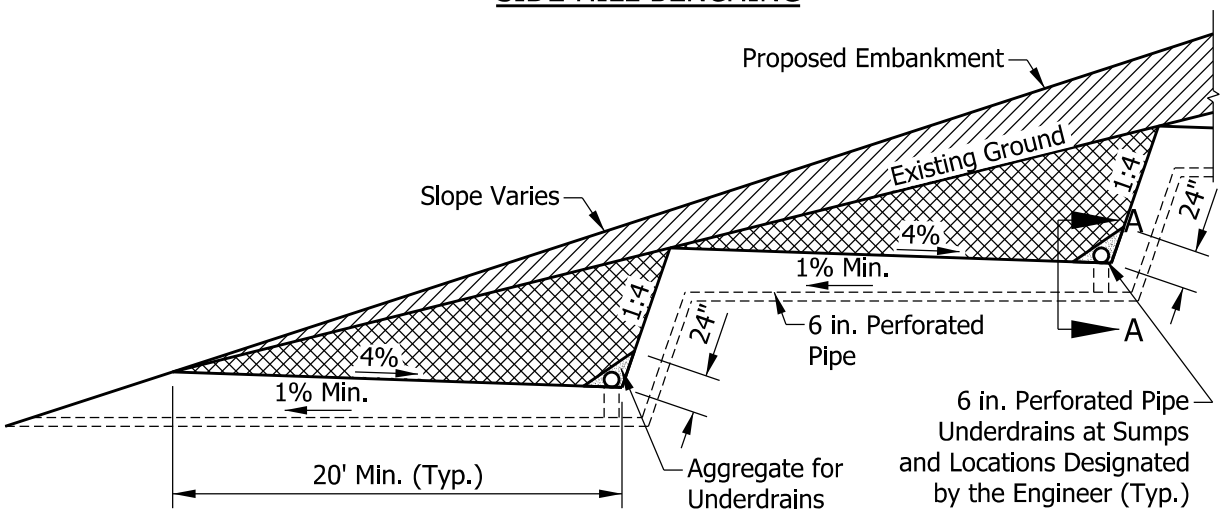


NOTES:

1. Do not include end areas in areas and volumes shown on cross sections.

2. Include the volumes for benching in both the cut and fill quantities shown on the plan and profile sheet for the balance or balances in which the quantities occur. Add the following note:
"The above quantities include ____ ft³ of cut and ____ ft³ of fill for benching from Sta. ____ to Sta. ____."

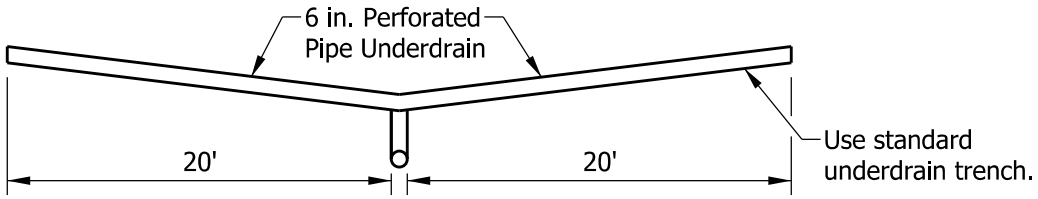
SIDE HILL BENCHING



NOTE: Continue benching to subgrade or toe of embankment slope.

Earth or Rock Embankment

Earth and/or Rock Excavation



SECTION A-A

BENCHING WHEN WATER IS ENCOUNTERED

TYPICAL BENCHING METHODS

Figure 107-6B

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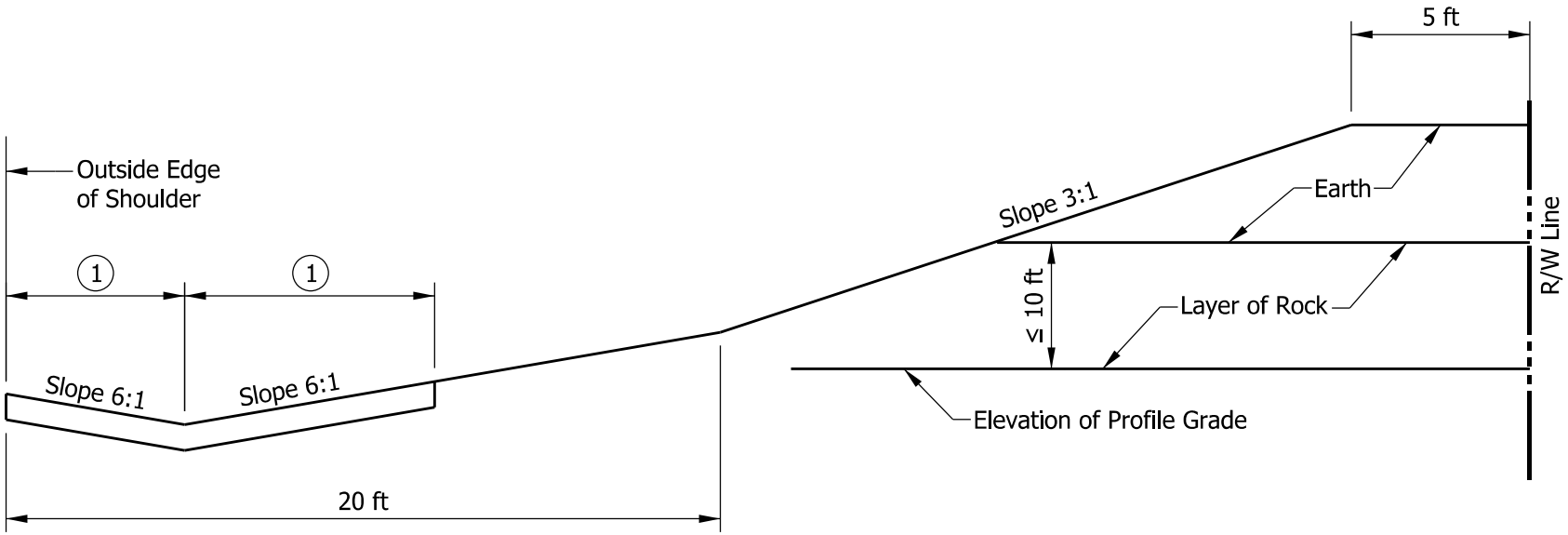

NOTE:

(1) Ditch dimensions vary according to hydraulic requirements.

TYPICAL ROCK CUT BENCHING, ROCK DEPTH ≤ 10 FT

Figure 107-6C

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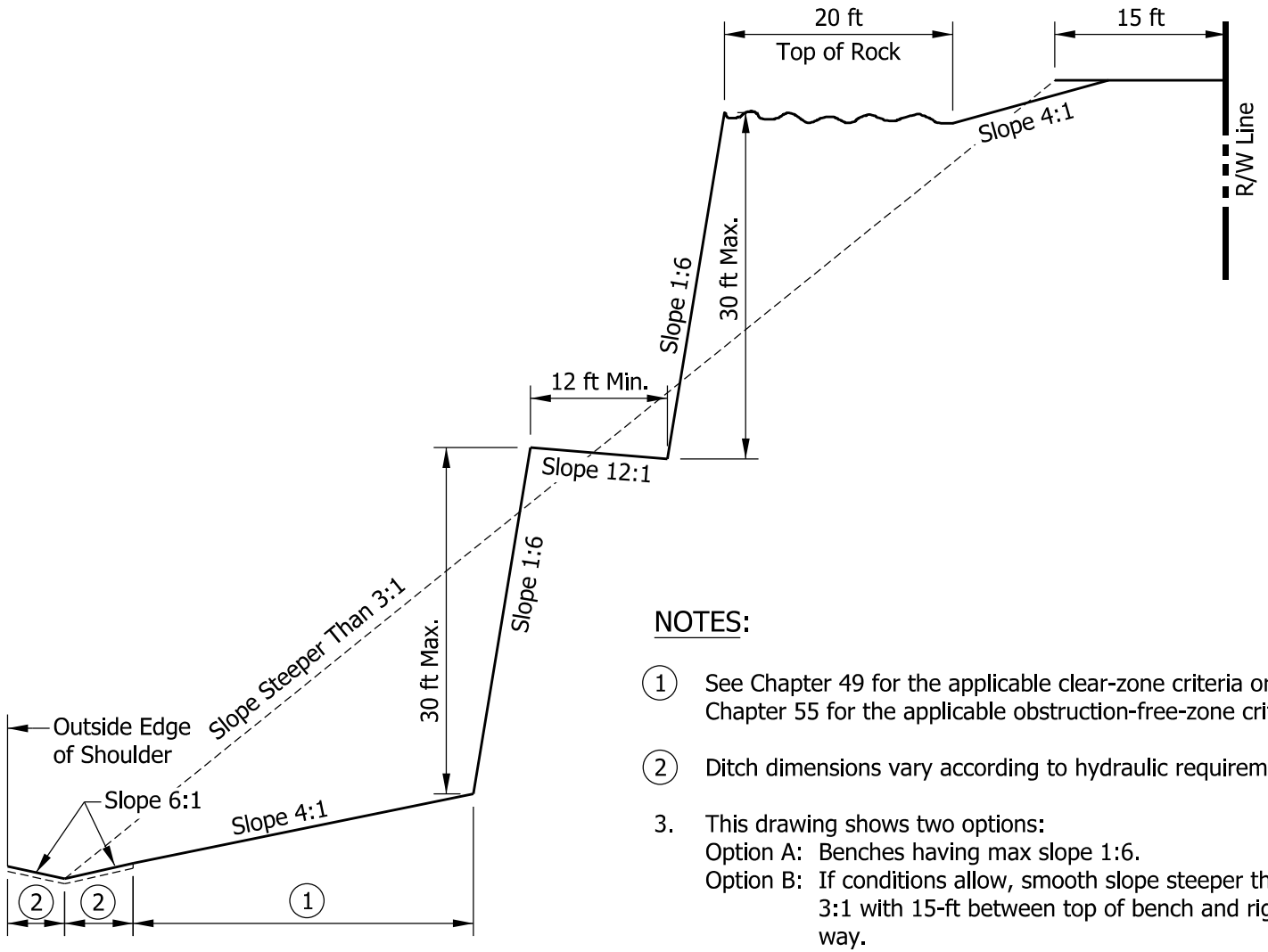

NOTES:

1. See Chapter 49 for the applicable clear-zone criteria or Chapter 55 for the applicable obstruction-free-zone criteria.
2. Ditch dimensions vary according to hydraulic requirements.
3. This drawing shows two options:
   Option A: Benches having max slope 1:6.
   Option B: If conditions allow, smooth slope steeper than 3:1 with 15-ft between top of bench and right of way.

TYPICAL ROCK CUT BENCHING
ROCK DEPTH > 10 FT

Figure 107-6D

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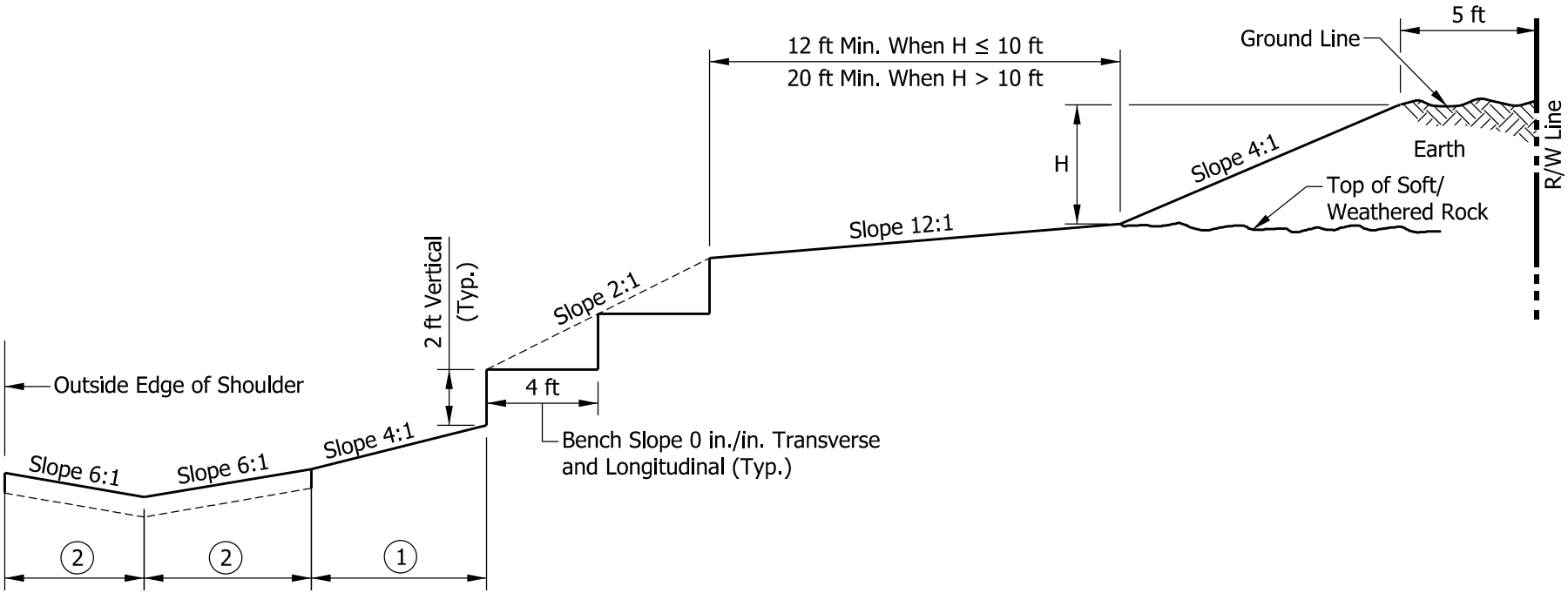

NOTES:

(1) See Chapter 49 for the applicable clear zone or Chapter 55 for the applicable obstruction-free zone criteria.

(2) Ditch dimensions vary according to hydraulic requirements.

TYPICAL SOFT/WEATHERED ROCK CUT BENCHING

Figure 107-6E

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